

Pharmacist-conducted medication reconciliation in an emergency department

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It is estimated that medication errors cause more than 7000 deaths per year in the United States.¹ Medication errors and patient harm can result from inaccurate or incomplete medication histories that are used as the basis for medication regimens. To ensure that medications are prescribed safely after hospital admission, it is necessary to have an accurate and complete medication history.²

Approximately 60% of errors occur when patients are admitted, transferred to another unit, or discharged.³ Dobrzanski and colleagues⁴ found that up to 27% of all prescribing errors that occur in the hospital result from incomplete medication histories at the time of admission. A report recently published by the Institute of Medicine outlined a thorough approach to decreasing the frequency of medication errors, including using information technologies and encouraging patients to take a more active role in their own medical care.⁵

Purpose. The effect of pharmacist-conducted medication reconciliation on compliance with a hospital's medication reconciliation policy was studied.

Methods. In this eight-week pilot study, one pharmacist worked in the emergency department (ED) to facilitate the safe and accurate transfer of medication histories for admitted patients. During the first four weeks, retrospective chart review was performed for 100 patients in March 2006 to determine the compliance rate to the hospital's medication reconciliation policy (medication reconciliation completed for every patient using the hospital-approved form). Over the next four weeks, the same pharmacist prospectively obtained medication histories from consecutive patients in April 2006; these patients comprised the study group. The pharmacist completed the medication reconciliation form and identified and corrected all discrepancies. Unpaired *t* tests and Fisher's exact test were used to determine significant differences between groups.

Results. The hospital-approved medica-

tion form was used for 78% of patients in the control group (78 of 100) and 100% of patients in the study group (60 of 60). The mean \pm S.D. number of errors per form was significantly higher in the control group than in the study group, and the percentage of forms containing at least one error was significantly higher in the control group ($p = 0.001$ for both comparisons). Allergy documentation was recorded for 62 patients in the study group versus all 60 in the study group ($p = 0.001$).

Conclusion. Pharmacist-conducted medication reconciliation in the ED increased compliance to the institution's medication reconciliation policy for admitted patients. Pharmacist-acquired medication histories had significantly fewer errors in documentation and had more documentation of patient allergies.

Index terms: Administration; Allergies; Compliance; Documentation; Errors, medication; Hospitals; Patient information; Pharmacists, hospital

Am J Health-Syst Pharm. 2007; 64:1720-3

The Joint Commission's National Patient Safety Goals require hospi-

tals to "accurately and completely reconcile medications across the

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The assistance of Gary Tataronis, M.S., Gregory A. Volturo, M.D., and Eric A. Alper, M.D., is acknowledged.

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DOI 10.2146/ajhp060436

continuum of care.” At UMass Memorial Medical Center in Worcester, Massachusetts, medication histories are obtained on admission by the admitting physician, either in the emergency department (ED) or on the unit once the patient has been transferred. A medication reconciliation form was developed and implemented in early 2003 to assist physicians in collecting accurate and complete medication histories. According to internal audits conducted by the Institute for Healthcare Improvements, this form was used in medication reconciliation at admission for 80–85% of patients at our medical center. Studies have shown that pharmacist-acquired medication histories are more accurate and contain fewer medical errors, thereby promoting patient safety.⁶⁻⁸ Furthermore, the Joint Commission views medication reconciliation as adverse-event prevention.⁹ The objective of this pilot study was to determine whether pharmacist-acquired medication histories in the ED would increase the rate of medication reconciliation for patients admitted to the hospital.

Methods

UMass Memorial Medical Center is a tertiary care, 815-bed teaching hospital, and the ED serves as the level 1 trauma center for the surrounding area. Of the estimated 78,000 patients who visit the medical center’s ED each year, 18% are admitted, comprising 63% of total admissions. Pharmacy services provided to the ED are limited to the centralized review of medication orders.

In this eight-week pilot study, one pharmacist worked in the ED to facilitate the safe and accurate transfer of medication histories for admitted patients. During the first four weeks of this study, a retrospective chart review was performed to determine the compliance rate to the hospital’s medication reconciliation policy (i.e., medication reconciliation is

completed for every patient using the hospital-approved form). Patients age 18 years or older were consecutively assigned to a control group if they were admitted through the ED between 9:00 a.m. and 5:00 p.m. Monday through Friday in March 2006 until 100 charts had been reviewed. Medication histories for the control group were obtained by the admitting physician.

The pharmacist reviewed each patient’s medical chart within 24 hours after admission and recorded the following: (1) number of patients for whom the hospital-approved medication reconciliation form was used, (2) number of errors of incompleteness (i.e., omitted patient name, allergy information, physician or nurse practitioner signature, drug name, dose, route, or schedule), (3) number of errors of inaccuracy (i.e., incorrect drug name, dosage form, dose, route, or schedule; as-needed order with no indication; unapproved abbreviation; illegible order), and (4) number of nonformulary drugs ordered based on the patient’s home medication regimen.

Over the next four weeks, the same pharmacist prospectively obtained medication histories from consecutive patients age 18 years or older admitted to the hospital through the ED between 9:00 a.m. and 5:00 p.m. Monday through Friday in April 2006. These patients comprised the study group. The pharmacist asked each patient about his or her use of prescription medications, nonprescription products, and herbal products. The pharmacist also recorded patients’ allergy information, height, and weight. The pharmacist completed the medication reconciliation form and identified and corrected all discrepancies. All questionable histories were verified with the patient’s family, outpatient pharmacy, or prescribing physician. Each declared allergy was assessed for timing, type of reaction, and severity and entered into the pharmacy’s database.

For patients not seen by the pharmacist, the admitting team was responsible for obtaining the medication history. To ensure continuity of care, the pharmacist contacted the admitting team to confirm that each patient’s medication history had been recorded and then verified and discussed any pharmacotherapeutic issues identified. In addition, issues discovered during medication review were brought to the attention of the ED team. All prospectively collected data were verified by a second pharmacist for completeness and accuracy.

The primary endpoint of this study was compliance with hospital policy that medication reconciliation is completed for every admitted patient using the hospital-approved form. Secondary endpoints included completeness and accuracy of the information on the medication reconciliation form and allergy documentation.

Unpaired *t* tests and Fisher’s exact test were used to determine whether statistically significant differences existed between the control and study groups regarding the use, completeness, and accuracy of medication reconciliation forms. Results of these analyses were considered significant when the *p* value was less than 0.05. All statistical analyses were performed using Number Cruncher Statistical Software (Jerry Hintze, Kaysville, UT).

Results

The mean \pm S.D. age of patients in the control group (63.3 ± 16.9 years) was significantly higher than in the study group (55.6 ± 19.9 years) ($p = 0.015$). The hospital-approved medication reconciliation form was used for 78% of patients in the control group (78 of 100) and 100% of patients in the study group (60 of 60) ($p = 0.001$). Further analysis of the control group found that medication reconciliation was completed for 4 (44%) of the 9 patients admitted to

an intensive care unit (ICU). The process was completed for 74 (81%) of the 91 patients admitted to the general medical units.

A total of 601 medications were recorded for the control group, compared with 378 for the study group. There was no significant difference in the mean \pm S.D. number of medications recorded per form between the control and study groups (7.7 ± 5.5 versus 6.3 ± 5.4 , respectively). A total of 117 errors were identified on the forms completed for patients in the control group, compared with only 2 errors for the study group. The mean \pm S.D. number of errors per form was also significantly higher in the control group (1.7 ± 2.1 versus 0.3 ± 0.7 for the study group ($p = 0.001$)). Furthermore, the percentage of forms containing at least 1 error was significantly higher in the control group (59%) than in the study group (3%) ($p = 0.001$). Of 117 total errors in the control group, 29% were deemed to be errors of inaccuracy, and 71% were considered errors of incompleteness. Common errors included missing dose (24%), missing route (21%), missing allergy information (14%), missing schedule (12%), as-needed order with no indication (12%), incorrect dose (8%), and incorrect dosage form (5%).

Allergy documentation was recorded for 62 patients in the control group (79%) versus all 60 patients in the study group (100%) ($p = 0.001$). Eighteen nonformulary drugs were being used by patients in each group.

Discussion

Many challenges have been faced by physicians, nurses, and pharmacists regarding the admission order process. Once the medication reconciliation form is completed by the admitting physician or nurse, it becomes an order for the pharmacy to review. At this time, computerized physician order entry is not available at our medical center. Each order is reviewed by a pharmacist and en-

tered into the pharmacy system for medications to become available to the patient's nurse through automated dispensing machines on each unit. Fifty-nine percent of medication histories collected for the control group contained at least one error that required follow-up by the pharmacist before the orders could be verified. This leads to additional time and effort and ultimately a delay in the availability of a patient's medication. Shifting pharmacist workload from following up on an error to actively taking patient medication histories in the ED may be a more productive use of time.

The percentage of medication reconciliation forms used to document home medications was much lower for patients admitted to the ICU (44%) than for patients admitted to a general medical unit (81%). Patients admitted to the ICU tend to be sicker than other admitted patients and may have been involved in a trauma or be under heavy sedation and receiving respiratory support. Many of these patients are unable to orally communicate and provide medication histories. Home medications are often not continued in this patient population until their acute illness or injury resolves. Also, family members may not be available to give accurate medication histories within the first 24 hours of admission.

Of the 117 errors in the medication histories of patients in the control group, 71% were errors of incompleteness. These types of errors most often lead to delayed administration of a patient's medication due to the time required by a pharmacist to clarify the order and dispense the right product. However, errors of inaccuracy, because they may not be detected immediately, have the potential to cause greater problems downstream. Fortunately, there are many checkpoints along the way to prevent such errors from occurring, at least while the patient is in the hospital.

The pharmacy database in the medical center has its own entry for allergies. In other words, if a nurse or physician enters an allergy for a patient, it will not cross over into the pharmacy database. The medication reconciliation form is usually the first medication order for a patient received by the pharmacy and has a section for allergies at the top of the page; however, allergies were documented for only 79% of patients in the control group. Conversely, allergy documentation, including an intense investigation of the allergy and appropriate documentation in the pharmacy database, was completed for 100% of patients in the study group. This finding is important because pharmacist-acquired medication histories could limit the number of adverse events related to inaccurate or incomplete allergy histories.

While the number of nonformulary drugs taken by patients at home may be less of a patient safety issue, a pharmacist can facilitate a switch to the formulary product in the absence of an automatic therapeutic substitution before the order ever reaches the pharmacy. For drugs that require pharmacist-physician consultation, a pharmacist in the ED can assist in the correct substitution.

Many hospitals have limited pharmacy services in the ED. Ideally, an ED pharmacist would provide clinical services such as education, code participation, toxicology consultations, and initial management of antibiotics. While it is important for a pharmacist to be involved in the clinical aspects of patient care, medication histories and allergy documentation are vital to appropriate patient care and are best handled by a pharmacist. In addition, pharmacists can monitor for potential drug interactions and inappropriate drug therapies.

We did not plan to exclude any patients; however, patients with intubation, extensive trauma, or other

medical conditions limiting communication were excluded during the study. It was not always possible to gather medication histories in the first few hours of admission; however, the hospital policy allows for 24 hours from admission to collect this information. A pharmacist in the ED may improve compliance to this Joint Commission standard for medication reconciliation but not necessarily to 100%.

Other limitations of this study include the retrospective design for the preintervention period compared with the prospective design during the postintervention period. This study was not powered to show any significant reduction in adverse events associated with errors in the medication histories. In addition, the number of errors in the medication histories of patients in the control

group clarified and fixed by the pharmacy was not recorded. Finally, bias was not controlled for, as the same pharmacist reviewed the medication histories of both groups.

Conclusion

Pharmacist-conducted medication reconciliation in the ED increased compliance to the institution's medication reconciliation policy for admitted patients. Pharmacist-acquired medication histories had significantly fewer errors in documentation and had more documentation of patient allergies.

References

1. Kohn LT, Corrigan JM, Donaldson MS, eds. *To err is human: building a safer health system*. Washington, DC: National Academy Press; 1999.
2. Lau HS, Florax C, Porsius AJ et al. The completeness of medication histories in hospital medical records of patients

admitted to general medicine wards. *Br J Clin Pharmacol*. 2000; 49:597-603.

3. Rozich JD, Resar RK. Medication safety: one organization's approach to the challenge. *J Clin Outcomes Manag*. 2001; 8:27-34.
4. Dobrzanski S, Hammond I, Khan G et al. The nature of hospital prescribing errors. *Br J Clin Govern*. 2002; 7:187-93.
5. Aspden P, Wolcott J, Bootman JL et al, eds. *Preventing medication errors: quality chasm series*. Washington, DC: National Academies Press; 2006.
6. Gleason KM, Groszek JM, Sullivan C et al. Reconciliation of discrepancies in medication histories and admission orders of newly hospitalized patients. *Am J Health-Syst Pharm*. 2004; 61:1689-95.
7. Bond CA, Raehl CL, Franke T. Clinical pharmacy services, hospital pharmacy staffing and medication errors in United States hospitals. *Pharmacotherapy*. 2002; 22:134-47.
8. Nester TM, Hale LS. Effectiveness of a pharmacist-acquired medication history in promoting patient safety. *Am J Health-Syst Pharm*. 2002; 59:2221-5.
9. Thompson CA. JCAHO views medication reconciliation as adverse-event prevention. *Am J Health-Syst Pharm*. 2005; 62:1528,1530,1532. News.